

Crediting Nutrient/Sediment Reductions from Agricultural Conservation Practices in the Chesapeake Bay Watershed Model

Frequently Asked Questions and Answers October 20, 2010

The U.S. EPA has developed the following fact sheet which provides answers to frequently asked questions regarding how the Chesapeake Bay Program partnership credits agricultural conservation practices and the associated nutrient and sediment reductions in the Chesapeake Bay Watershed Model. It addresses the following questions:

- What is the scientific basis for practice effectiveness estimates used in the Chesapeake Bay Watershed Model?
- What practices are currently approved and credited in the model?
- What “new” practices that states are considering in the Phase I Watershed Implementation Plans are currently approved with an interim efficiency for use in the model?
- What practices are under consideration for use in the model, but not yet approved?
- What is the process is for crediting non-cost shared practices (often referred to as “voluntary”)?

Question: What is the scientific basis for conservation effectiveness estimates used in the Chesapeake Bay Watershed Model?

Answer: For every best management practice in the model, the Chesapeake Bay Program has a definition and “effectiveness estimate” which describes the nutrient and sediment reductions that result from these practices. The conservation effectiveness estimates used in the Chesapeake Bay Watershed Model are based on extensive peer-reviewed scientific literature, field studies, and input from technical panels comprised of USDA, NRCS, state land grant universities, agricultural agencies, and key practitioners in the field who design, implement and maintain these practices.

The Chesapeake Bay Program partnership recently funded University of Maryland’s Mid-Atlantic Water Program (comprised of the major land grant universities throughout the Mid-Atlantic region) to complete a 2-year study to update these effectiveness estimates. The result of this study is a 900 page report that summarizes for each practice all data evaluated, the technical experts involved in developing the recommendations, and an accounting of all discussions and decisions made. The recommendations put forth by the expert technical panels were fully vetted and approve by all relevant Chesapeake Bay Program committees and subcommittees which have full representation from all Bay watershed jurisdictions and include the state agricultural agencies, land grant universities, and USDA. This study not only resulted in scientifically defensible effectiveness estimates for all major agricultural conservation practices, but also resulted in a process to follow for developing or updating effectiveness estimates for BMPs in the model in the future.

There is very good agreement among EPA, USDA, and the state agricultural and environmental agencies on what practices offer the greatest nutrient and sediment reductions as evidenced by a very similar list of priority practices in EPA's "502 Guidance" for federal land management in the Chesapeake Bay Watershed, the Chesapeake Bay Commission's report on Cost Effective Strategies for the Bay, the USDA Conservation Effectiveness Assessment Project study results, USDA NRCS's list of priority practices for the Chesapeake Bay Watershed Initiative Farm Bill program, and the state Chesapeake Bay TMDL Watershed Implementation Plans.

The scientific report summarizing all data backing the effectiveness estimates used in the Chesapeake Bay Watershed Model and the resulting protocol for approving BMPs for credit in the model can be found at:

http://archive.chesapeakebay.net/pubs/BMP_ASSESSMENT_REPORT.pdf

http://archive.chesapeakebay.net/pubs/Nutrient-Sediment_Control_Review_Protocol.pdf.

Question: What agricultural conservation practices does the Chesapeake Bay Program Watershed Model currently credit for use in model?

Answer: The Chesapeake Bay Program Watershed Model currently credits over 40 agricultural practices (available at: http://archive.chesapeakebay.net/pubs/NPS_BMP_Table1_5.pdf). Note that cover crops are further divided into 44 different practices with different efficiencies based on benefits that vary according to species, seeding methods and planting dates. These practices all underwent review and approval by the Chesapeake Bay Program based on the *Protocol for the Development, Review and Approval of Loading and Effectiveness Estimates for Nutrients and Sediment Controls in the Chesapeake Bay Watershed Model* (available at http://archive.chesapeakebay.net/pubs/Nutrient-Sediment_Control_Review_Protocol.pdf).

Question: Can EPA accept additional practices for use in the model? Is there a "lock down" period where EPA cannot accept practices?

Answer: EPA can accept additional verified practices for use in the model on an on-going basis. The Chesapeake Bay Program Watershed Model can accommodate any practice and program across all sectors (agriculture, urban, wastewater, forestry, etc.) that yields load reductions in nutrients and/or sediment. In the Watershed Implementation Plans, those verified practices that were implemented after the calibration period (practices put in place in 2006 or later) will count towards annual pollution reduction progress and towards the 2-year milestones. Practices implemented prior to 2006 will be utilized by the model in the next calibration period.

For all practices to be credited for use in annual model progress runs, the practice must be evaluated through the Chesapeake Bay Program's *Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model* (available at http://archive.chesapeakebay.net/pubs/Nutrient-Sediment_Control_Review_Protocol.pdf).

Because this formal BMP credit approval process takes two or more months to finalize, EPA is allowing the development of "interim efficiencies" of any practices states are including in their Watershed Implementation Plans that are not currently in the model. By allowing an interim or

“place-holder” efficiency, states are able to estimate the pollutant load reduction they are likely to achieve by implementing these practices. This analysis will help states finalize the mix of practices to include in the Watershed Implementation Plan to assure that they can meet the nutrient and sediment allocations. The guidance that EPA has given all states on this topic is included in “*A Guide for EPA’s Evaluation of Phase I Watershed Implementation Plans*” (available at http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/GuideforEPAWIPEvaluation4-2-10.pdf). The guidance indicates: “*for those practices and programs whose definitions and quantified benefits have not been evaluated through the EPA-approved peer review process, the WIP needs to identify a commitment to do so and provide placeholder documentation for the practice effectiveness for near-term model evaluation. If place-holder practice effectiveness used in the model evaluation of the WIP exceeds the eventual peer-reviewed effectiveness, jurisdictions need to commit to implement BMPs at a higher level to offset the shortfall or otherwise modify the WIP.*”

Question: What are the “new” practices that EPA has approved for use in the model for the Phase I Watershed Implementation Plans so far?

Answer: EPA continues to work with the states to add additional “new” practices for credit in the model in order to estimate the resulting nutrient and sediment reductions from the Watershed Implementation Plans. The following interim agricultural BMP definitions and associated Phase 5.3 placeholder effectiveness values have been proposed and accepted by the Chesapeake Bay Program Office on a provisional basis for use in the development of Bay TMDL Watershed Implementation Plans (WIPs) by the jurisdictions (as of October 18, 2010). The Scenario Builder loads are posted at ftp://ftp.chesapeakebay.net/Modeling/phase5/Phase53_Load-Acres-BMPs/ or on the SharePoint account for these practices in relevant states.

Although these interim BMPs have been developed in conjunction with available scientific information, supporting documentation has typically been incomplete. Thus, the interim definitions and placeholder effectiveness values are subject to change prior to being formally adopted by the partnership. In order for the jurisdictions to include future implementation of these practices towards achieving their TMDL goals through their annual progress reports or their two-year milestones reports, these interim BMPs must receive approval by the CBP partnership. The process adopted by the Water Quality Goal Implementation Team (WQGIT) on March 15, 2010 for reviewing and approving new BMPs is addressed in the *Protocol for the Development, Review and Approval of Loading and Effectiveness Estimates for Nutrients and Sediment Controls in the Chesapeake Bay Watershed Model* document (available at http://archive.chesapeakebay.net/pubs/Nutrient-Sediment_Control_Review_Protocol.pdf).

Interim Agricultural BMPs

1. Cropland Irrigation Management

Cropland under irrigation management is used to decrease climatic variability and maximize crop yields. The potential nutrient reduction benefit stems not from the increased average yield (20-25%) of irrigated versus non-irrigated cropland, but from the greater consistency of crop yields over time matched to nutrient applications. This increased consistency in crop yields provides a subsequent increased consistency in plant

nutrient uptakes over time matched to applications, resulting in a decrease in potential environmental nutrient losses.

The current placeholder effectiveness value for this practice has been proposed at 4% TN, 0%TP and 0%TSS, utilizing the range in average yields from the 2002 and 2007 NASS data for irrigated and non-irrigated grain corn as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive or do not receive manure.

2. Cropland Drainage Phosphorus-sorbing Materials (PSMs)

The University of Maryland and the USDA Agricultural Research Service (ARS) have demonstrated through an existing research project at the University of Maryland-Eastern Shore the application of “Phosphorus-sorbing” materials to absorb available dissolved phosphorus in cropland drainage systems for removal and reuse as an agricultural fertilizer. These in-channel engineered systems can capture significant amounts of dissolved phosphorus in agricultural drainage water by passing them through phosphorus-sorbing materials, such as gypsum, drinking water treatment residuals, or acid mine drainage residuals.

The current placeholder effectiveness value for this practice has been proposed at 0% TN, 40%TP and 0%TSS, utilizing a conservative estimate in phosphorus removal measured by the UMD/ARS research project as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive or do not receive manure. Based upon the documentation, the proposed practice is currently limited to Coastal Plain soils with shallow groundwater levels requiring drainage ditches for agricultural production.

3. Liquid Manure Injection

The subsurface application of liquid manure from cattle and swine has been demonstrated in research studies to significantly reduce nutrient losses for both surface runoff and ammonia emissions. Recent studies by Pennsylvania State University (PSU) and USDA-ARS indicate that the effectiveness of the practice is dependent on the technology used for injection, and that some systems are not consistent with the USDA-NRCS management requirements for high residue management systems; e.g. Continuous No-Till. This proposed practice is indicative of low disturbance soil injection systems and is not appropriate for tillage incorporation or other post surface application incorporation methods.

The current placeholder effectiveness value for this practice has been proposed at 25% TN, 0%TP and 0%TSS, utilizing a conservative estimate in combined nutrient and sediment loss reductions by current university and ARS research as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive manure, pasture and hay with manure.

4. Poultry Manure Injection

The subsurface injection of poultry manure has been demonstrated in university and USDA-ARS research studies to significantly reduce nutrient losses for both surface runoff and ammonia emissions. Recent studies by universities and USDA-ARS indicate that dry manure injection is feasible and effective by utilizing current research technology. These systems are also consistent with the USDA-NRCS management requirements for high residue management systems; e.g. Continuous No-Till. This proposed practice is indicative of low disturbance soil injection systems and is not appropriate for tillage incorporation or other post surface application incorporation methods.

The current placeholder effectiveness value for this practice has been proposed at 25% TN, 0%TP and 0%TSS, utilizing a conservative estimate in combined nutrient and sediment loss reductions by current university and ARS research as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive manure, pasture and hay with manure.

5. Mortality Incineration

The definition of the approved BMP entitled *Mortality Composting* does not include the alternative process of incineration practiced by some livestock operations. The proposed interim practice of Mortality Incineration is defined as a physical structure and process for disposing of dead livestock and poultry through incineration versus composting. The resulting ash material is land applied using nutrient management plan recommendations.

The current placeholder effectiveness value for this practice has been proposed at 40% TN, 10%TP and 0%TSS, utilizing the existing Mortality Composting effectiveness estimate as a reference. The proposed practice is applied on a livestock type and operation basis, and can be implemented and reported for the AFO land use.

6. Vegetative Environmental Buffers (VEB)

A vegetative environmental buffer, or VEB, is the strategic dense planting of combinations of trees and shrubs around poultry houses to address environmental, production, and public relations issues. Research conducted by the University of Delaware have indicated that mature tree plantings can offer filtration benefits for poultry operations by entrapping dust, odor, feathers, and noise emitted by air exhaust from ventilation systems. Documentation on the effectiveness of VEB's in reducing nitrogen losses to the environment through ammonia emission reductions is currently non-conclusive.

The current placeholder effectiveness value for this practice will be described as a land use change for the area directly planted to trees and shrubs. The proposed practice is applied on a per acre basis, and results in a conversion to forest land from cropland, on both lo-till and hi-till land uses that receive manure or do not receive manure, pasture or hay land with or without nutrients.

It's important to note that a recent scientific analysis report from the University of Maryland/Mid-Atlantic Water Program, funded by EPA, indicated that the practice has not undergone a science-based evaluation by the Chesapeake Bay Program Partnership to be included on the official list of agricultural BMPs in the models. Available scientific data on the potential nutrient reductions associated with VEB's is unfortunately very limited at this time. A recent study conducted by Dr. Bud Malone with the University of Delaware on VEB's demonstrated the ability of vegetative buffers to remove (filter) dust and associated ammonia emissions vented from poultry houses. Unfortunately, the study was not able to determine the fate of those emissions once they were filtered by the vegetation. The Chesapeake Bay Program Partnership's Agriculture Workgroup, which is responsible for recommending new agricultural BMPs to the Partnership for inclusion in the models, has identified this issue as one needing further research and study to determine the potential nutrient reduction effectiveness values.

7. Manure Processing Technology

As part of the innovative advanced technology element for the Watershed Implementation Plan (WIP), PA DEP is working with the Pennsylvania Department of Agriculture and a number of companies looking to install various technologies such as methane digesters and electrical co-generation on dairy, poultry and hog operations. Many of these technologies can produce electricity and marketable soil amendments; reduce methane emissions; and generate renewable energy, nutrient reduction and carbon credits that can then be sold.

Some forms of technology, such as digesters, alone will not substantially change the nutrient content of manure. Pennsylvania is looking more closely at technologies that include a process element that helps ensure overall nutrient reductions. Examples of nutrient processing technology include: denitrification; solids separation; flocculation, combustion, etc.

DEP has formally approved several technologies for nutrient credit generation. As part of this approval, a process for quantifying credits is approved as well as a plan to verify the reductions. Each technology or process has been different, but the approvals contain several common requirements critical to quantification such as 1) Throughput of manure is monitored for the quantity being processed; 2) Sampling for nutrient content is performed at various key stages of the process, such as the inlet and the outlets to the process; and 3) The number of credits are reduced if the overall process indicates a need to account for either the process' product potentially introducing reduced nutrients back to the watershed (e.g. stack emissions), or if nutrients are applied to replace manure that was previously land applied.

To allow for recognition in the Watershed Implementation Plan of the nutrient reductions associated with manure processing technology efforts, EPA has worked with PA to develop a placeholder Best Management Practice (BMP) and a process for crediting the resulting nutrient reductions.

Question: What “new” practices are under consideration for use in the model, but not yet approved?

Answer: The only new practice submitted by the Bay states that EPA has not yet provided credit for is Poultry Heavy Use Pads, due to the lack of data to substantiate nutrient/sediment reductions. Although there's a significant level of financial investment in this practice in some regions of the watershed, Bay Program agricultural experts and modelers have not received indications or information from the academic, extension, or public community that there are significant net nutrient reductions associated with the practice.

The pads can increase the stormwater runoff (and, therefore, nutrient and sediment fluxes) due to increased imperviousness and loss of filtering capability. Standard designs don't currently provide any stormwater controls or collections. The Bay Program does not believe nutrient and sediment effectiveness values can be substantiated at this time since research, in-field, state and federal agency documentation is insufficient. To date, states have not provided information to the Bay Program office that meets EPA requirements, which are: *"For WIP practices and programs whose definitions and quantified benefits have not been evaluated through the EPA-approved peer-review process, the WIP needs to identify a commitment to do so and provide placeholder documentation for the practice effectiveness for near-term model evaluation. If place-holder practice effectiveness used in the model evaluation of the WIP exceeds the eventual peer-reviewed effectiveness, jurisdictions need to commit to implement BMPs at a higher level to offset the shortfall or otherwise modify the WIP."*

Question: Does EPA credit the following practices: poultry litter treatments, mortality composters, structural and vegetative shore erosion protection, stream restoration in non-coastal plains, and loss of agricultural land?

Answer: Yes. EPA has already provided credit for these practices historically in the model.

Poultry Litter Treatments: Benefits of poultry litter treatments (such as alum) ARE included in the model, but the credit given is rudimentary and will change in future versions of the model.

Mortality Composters: A quantification of the benefits of mortality composting HAS BEEN in the model for several years for both "progress" assessments and jurisdictional implementation plans - even though the root source of nutrients (in dead animals) is not yet specifically considered in the model.

Structural and Vegetative Shore Erosion Protection: Vegetated Open Channels in agriculture was proposed and credited for WIPs. Shoreline Erosion Controls have traditionally been given credit, but this relates more to other non-agricultural sectors since shorelines are typically, but not always, developed.

Stream Restoration in Non-Coastal Plain: Non-urban stream restoration is a practice quantified in the Chesapeake Bay Program Watershed Model.

Loss of Agricultural land: The Chesapeake Bay Watershed Model has always accounted for changes in agricultural land area over time - as it does with urban land types and forest. The loss of agricultural land in the model (and in the real world) does not yield a nutrient load reduction if the manure nutrients in a given region are increasing over time, unless offset by BMPs, which the model takes into consideration to best mimic on-the-ground conditions. Simply put, increasing nutrients on less land produces greater application rates to cropland - unless offset by BMPs. A typical condition in the watershed, however, is that the agricultural land loss accompanies reductions in manure nutrient generation, which is "credited" in the model.

Question: Can EPA accept “voluntary” practices in the model?

Answer: Yes, EPA can accept verified “voluntary” practices in the model. Voluntary practices are those practices that have not been funded through Federal Farm Bill or state cost share and, therefore, have not been tracked by or reported to EPA for use in the model. These voluntary practices are typically funded by farmers alone (or possibly through other funding sources besides state cost share or Federal Farm Bill funding such as grants or private sources). EPA is committed to working with USDA, NACD, State environmental and agricultural agencies, conservation districts, and agricultural community at large to credit nutrient and sediment reductions from voluntary practices. As committed to in the Chesapeake Bay Executive Order Strategy EPA and USDA will work with state and local partners to “By July 2012, mechanisms for tracking and reporting of voluntary conservation practices and other BMPs installed on agricultural lands will be developed and implemented.”

EPA can accept additional verified practices for use in the model on an on-going basis. The Chesapeake Bay Program Watershed Model can accommodate any practice and program across all sectors (agriculture, urban, wastewater, forestry, etc.) that yields load reductions in nutrients and/or sediment. In the Watershed Implementation Plans, those verified practices that were implemented after the calibration period (practices put in place in 2006 or later) will count towards annual pollution reduction progress and towards the 2-year milestones. Practices implemented prior to 2006 will be utilized by the model in the next calibration period.

EPA is allowing for interim “placeholder” effectiveness estimates (based on data provided by the state) so that states can estimate nutrient and sediment reductions resulting from the actions outlined in the Phase I Watershed Implementation Plans. These “placeholder” estimates must be verified through the formal BMP credit approval process for use in annual progress reports and to count towards progress made towards 2-year milestones.

Verifying these data for use in the model is critical for determining the appropriate nutrient and sediment reduction credit for the model. EPA has been meeting with USDA, NACD, state agricultural agencies, conservation districts, and agricultural community for over a year to develop protocols for tracking, reporting, and verifying these data for use in the model. EPA needs verification procedures and information that shows that practices are properly designed, installed, and maintained in order to credit nutrient and sediment reductions. EPA has clearly articulated key expectations of what data are needed in order to credit practices in the model in numerous correspondence to the states on Watershed Implementation Plan expectations:

- o BMP approval process - rigorous, scientific defensible process for evaluating data, getting technical input, and finalizing definitions and effectiveness estimates for use in model. All practices must undergo this CBP partnership-approved BMP review protocol in order to be credited in the model.
- o Verification procedures – EPA has clearly spelled out in communications with the states on the Watershed Implementation Plans its expectations regarding verifying that practices were properly designed, installed, and maintained to get full credit in the model.
- o Ensuring no double-counting – It will be very important to ensure that there is no double-counting of practices that are reported for use in the model. For cost-shared practices, this could happen if the practice was co-funded through both the Federal Farm Bill and state cost share programs. For voluntary data, this could happen if the farmer received grant funding for a practice. EPA has asked for the states to put measures in place to ensure no double-reporting of practices.
- o Procedures for keeping dataset clean over time (deleting practices if they are removed, if land is converted, if they aren't maintained, if they fail, etc.).
- o Data transmission requirements to EPA – In EPA's grant guidance to the states, EPA has clear guidelines for how data must be transmitted to the EPA for use in the model through the NEIEN network node.

EPA has provided financial support to states to more accurately and comprehensively account for agricultural conservation on the ground through grants to the states. Additionally EPA will house two National Association of Conservation District (NACD) employees at CBPO to coordinate voluntary data tracking effort, as requested by NACD.

Question: Where are the EPA Memos and Guides that outline the key Expectations for Data Tracking, Reporting, and Verification?

Answer: Links for the more detailed guidance on reporting and verification of agricultural conservation data can be found at:

- o A Guide for EPA's Evaluation of Phase I Watershed Implementation Plans - http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/GuideforEPAWIPEvaluation4-2-10.pdf
- o Letter to Chesapeake Bay Program Principals' Staff Committee Outlining EPA's Expectations for Watershed Implementation Plans (November 4, 2009) http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/tmdl_implementation_letter_110409.pdf
- o Letter to Chesapeake Bay Program Principals' Staff Committee outlining the EPA Chesapeake Bay Accountability Framework and consequences (December 29, 2009) - http://www.epa.gov/region03/chesapeake/bay_letter_1209.pdf